AIS Indexer User Guide

Dan Radulescu

Prepared by:

OODA Technologies Inc.
4891 Av. Grosvenor, Montreal Qc, H3W 2M2

Project Manager: Anthony W. Isenor
Contract Number: W7707-115137, Call Up 6, 4500959431
Contract Scientific Authority: Anna-Liesa S. Lapinski

The scientific or technical validity of this Contract Report is entirely the responsibility of the contractor and the contents do not necessarily have the approval or endorsement of the Department of National Defence.

Contract Report
DRDC-RDDC-2014-C20
November 2012

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
NOV 2012		**00-00-2012 to 00-00-2012**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
AIS Indexer User Guide	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **OODA Technologies Inc,4891 Av. Grosvenor,Montreal Qc, H3W 2M2,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

A Coverage Index Generator Java application was developed in the summer of 2011, based on the work of Lapinski and Isenor (Estimating Reception Coverage Characteristics of AIS, Lapinski and Isenor, Journal of Navigation, October 2011). This application gathers Automatic Identification System (AIS) messages and produces a coverage map, graphically representing the quality and fidelity of signals received by coastal sensors. The application gathers its inputs either from static data files or a streaming input source. This report describes the AIS-Indexer functionalities provided to the user. It also describes how to install and configure the application. This application was initially developed in 2011. OODA Technologies improved the application in 2012 under call-ups 5 [1] and 6 [2] to the standing offer W7707-115137.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**17**	

© Her Majesty the Queen in Right of Canada as represented by the Minister of National Defence, 2012

© Sa Majesté la Reine (en droit du Canada), telle que représentée par le ministre de la Défense nationale, 2012

Abstract

A Coverage Index Generator Java application was developed in the summer of 2011, based on the work of Lapinski and Isenor (Estimating Reception Coverage Characteristics of AIS, Lapinski and Isenor, Journal of Navigation, October 2011). This application gathers Automatic Identification System (AIS) messages and produces a coverage map, graphically representing the quality and fidelity of signals received by coastal sensors. The application gathers its inputs either from static data files or a streaming input source.

This report describes the AIS-Indexer functionalities provided to the user. It also describes how to install and configure the application. This application was initially developed in 2011. OODA Technologies improved the application in 2012 under call-ups 5 [1] and 6 [2] to the standing offer W7707-115137.

This page intentionally left blank.

Table of contents

Abstract i

Table of contents iii

List of figures iv

1 Getting Started 1

1.1 Installation and Setup 1

1.2 Installation and Setup 1

1.3 Starting The Application From The Command Line 2

2 Generating Maps 3

2.1 Options Panel 3

2.2 Static Map Generation 3

2.3 Live Map Generation 4

3 Viewing Maps 6

4 Loading Maps 7

5 Monitoring Ship Traffic 8

6 Publishing Maps To GeoNetwork 9

References 10

List of symbols/abbreviations/acronyms/initialisms 11

List of figures

Figure 1: A view of the AIS Indexer after running the jar executable. 1

Figure 2: The recommended installation structure. 2

Figure 3: The user can generate a new map or open an existing map. 3

Figure 4: Screenshot of the file explorer displayed to the user for the static map generation. 4

Figure 5: Screenshot of the option panel in the static map case. 5

Figure 6: Screenshot of the Map Viewer window. Notice the outline of North America, the Baltic, the Mediterranean, and North Africa. 6

Figure 7: Screenshot of the file explorer displayed to the user when loading existing maps. 7

Figure 8: Screenshot of the Map Viewer when the ship monitoring is on. The position of the selected alert (on the right side) is displayed on the map with a cross. 8

1 Getting Started

This section describes how to start and configure the AIS Indexer.

1.1 Installation and Setup

The AIS Indexer is packaged in a .jar file and can be run from any location on the file system. It is recommended however that the jar file be placed in its own separate folder, e.g. `AIS-Indexer`, as it will make file navigation easier in the long run.

In order to publish maps to the GeoNetwork site, a publisher script provided with the installation package (zipped under `GeoNetworkScript.zip`) needs to be present somewhere on the local disk. The simplest solution is to place the script in a folder placed in the same folder as the jar file.

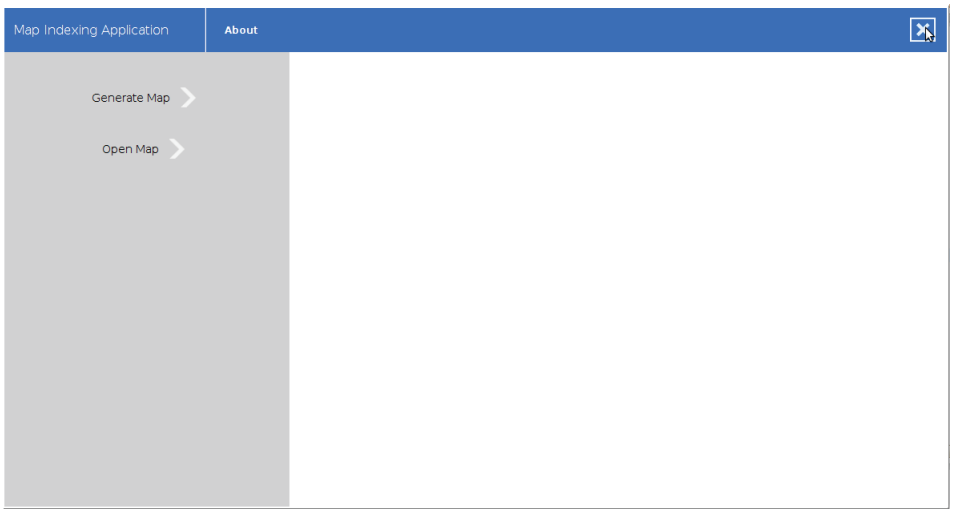

Figure 1: *A view of the AIS Indexer after running the jar executable.*

To setup the application requires running the jar file once by double clicking on it then closing it (Figure 1 shows the AIS Indexer at startup). To close the application, simply click on the *X* button on the top-right corner of the window. Running the application will generate 3 new subfolders (`Config`, `Monitored Alerts`, and `Saved Maps`). The screenshot in Figure 2 below shows a typical file structure after running the jar file.

1.2 Installation and Setup

Close the AIS Indexer and open the `Config` folder and the `app.config` file within. The HostName and Port parameters define the socket connection used by the AIS Indexer to retrieve live AIS messages. Replace `localhost` and `9999` respectively with the socket

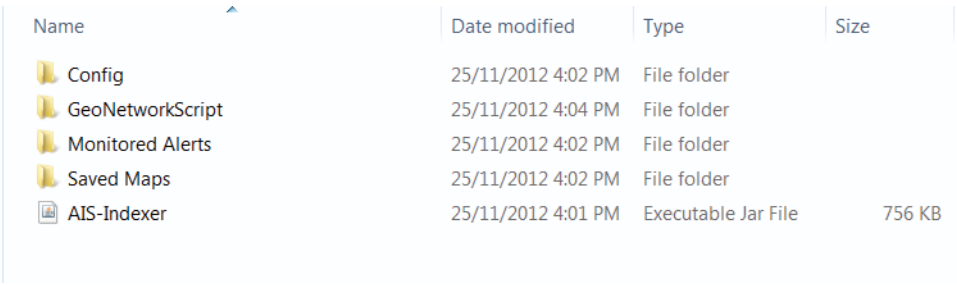

Figure 2: *The recommended installation structure.*

Internet Protocol (IP) and port values you wish to connect to. Set the publisher path to the location of the `publish.py` script. See below for an example:

```
PublisherPath=C:\Users\Username\workspace\AIS-Indexer\GeoNetworkScript\publish.py
```

Note that the AIS Indexer must be run at least once to create the `app.config` file.

1.3 Starting The Application From The Command Line

Starting the application from the command line is not necessary but it does have some advantages, the most important of which is the ability to specify the amount of memory usable by the application.

To do this (on the Windows Operating System), first open a command interface by typing `cmd` in the search bar right above the *Windows* button and then pressing *Enter*. The `cmd` path should point to `C:\Users\Username` by default. Use the `cd <filepath>` command to navigate to the `AIS-Indexer` folder.

To run the application with a specified memory size (e.g. 1 Gigabyte (GB)) type:
`java -jar -Xmx1024m AIS-Indexer.jar`
where `-Xmx1024` sets the maximal amount of memory used to 1024 megabytes (or 1GB). Large maps will require a lot of memory so this procedure is generally recommended.

2 Generating Maps

This section explains how to generate maps using the AIS Indexer application. Figure 3 illustrates the options left to the user from the *Main Panel*: generate a map or open an existing map. To start off map generation click the *Generate Map* button.

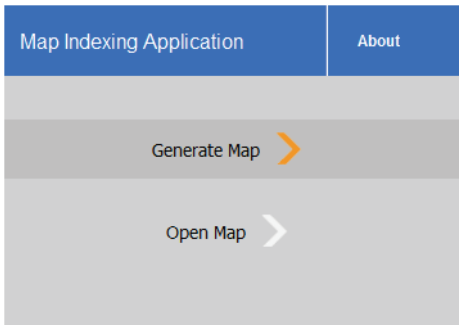

Figure 3: *The user can generate a new map or open an existing map.*

2.1 Options Panel

After clicking on *Generate Map*, the user is presented with the choice of *Static* or *Live* map. Clicking on either one will reveal more options specific to the selected map type.

2.2 Static Map Generation

To generate a map from a static log file, use the file explorer to navigate to the file you wish to add and click the *Add* button in the bottom right corner. See Figure 4 for a view of the file explorer. Several files can be added when generating a single map, however the same log file cannot be included twice.

Log files are not provided with the installation package. These files are generated by other scripts already in the possession of Defence Research and Development Canada (DRDC) (see annex of [2] for an example of such a file).

The user can also include map-specific options in the options panel after selecting the map type. See Figure 5 for a screenshot of the option panel in the static case. For the static case, the user can specify the map's start and end date, the geographic bounding box and the cell precision. The only mandatory field is the cell precision which dictates the resolution of the map. The smaller the cell size, the higher the map resolution. If the time and geographic bounds are not specified (all 0 or empty by default), the map will be generated with all the data available in the selected log file(s). Conversely, specifying geographic and time bounds will exclude the AIS reports in the logs, that are outside of the specified bounds.

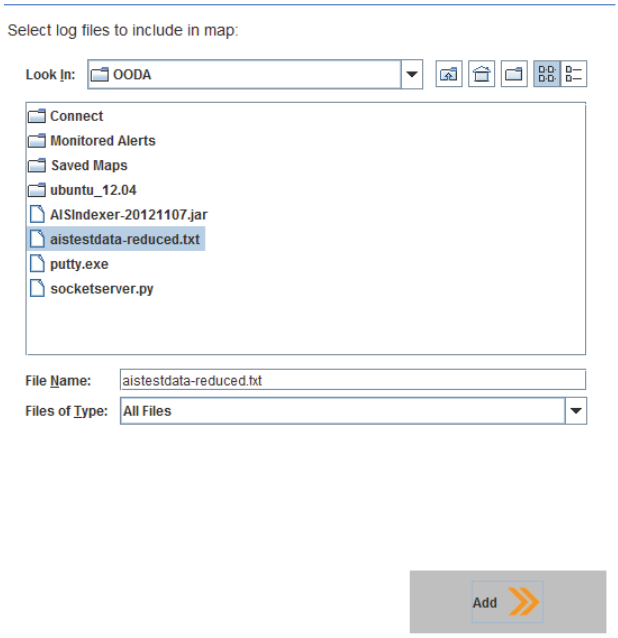

Figure 4: *Screenshot of the file explorer displayed to the user for the static map generation.*

Some restrictions apply when specifying bounds. In the case of time bounds, the end time must take place after the start time. In the case of geographic bounds, the northern latitude must be greater than the southern latitude and the eastern longitude must be greater than the western longitude. Furthermore, latitude values range between [-90.00, 90.00] degrees and Longitude values range between [-180.00, 180.00] degrees.

By clicking the *Run* button, the map will be generated with the user specified options.

2.3 Live Map Generation

Generating live maps is similar to the static case with two major distinctions, the first is that all boundary options must be specified (there are no default values). The second difference is that for the live case the start and end times are replaced by the window period and refresh interval. The window period represents the length of time data are included in the map while the refresh interval represents how often the map will be generated. For example, a map can contain a total of 12 hours worth of AIS data (the window period), and can refresh every 4 hours.

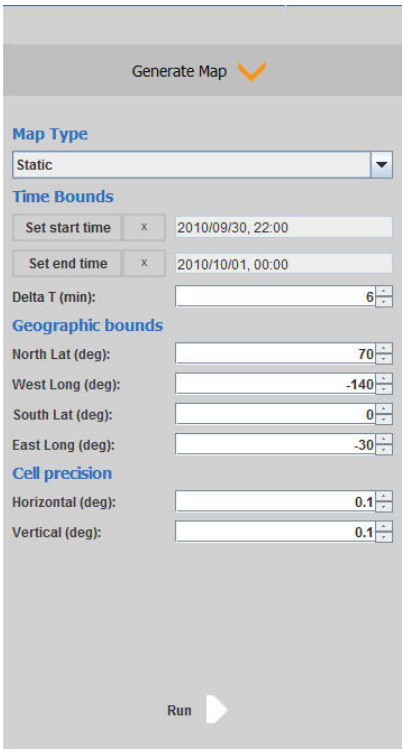

Figure 5: *Screenshot of the option panel in the static map case.*

3 Viewing Maps

All maps are viewed in the *Map Viewer* window (see Figure 6). This interface allows the user to navigate the map by zooming with the mouse wheel and clicking and dragging the map in the same way he/she would use Google Maps [1]. The *Map Viewer* also contains a panel detailing all the specifics of the current map including time and geographic bounds as well as monitoring info.

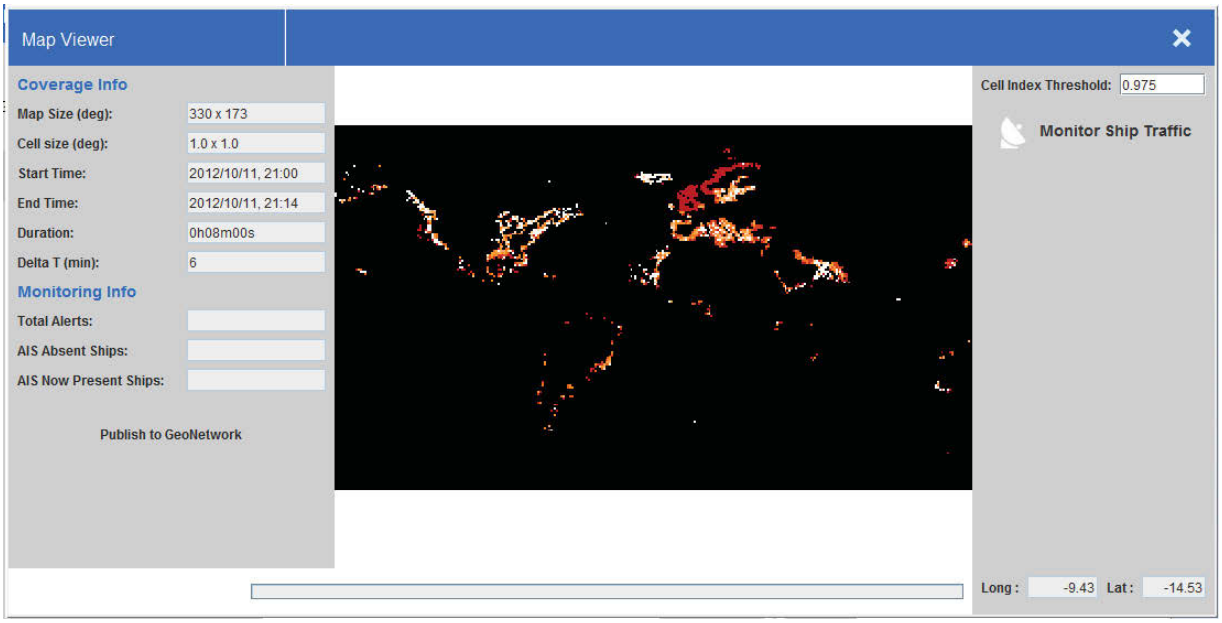

Figure 6: *Screenshot of the Map Viewer window. Notice the outline of North America, the Baltic, the Mediterranean, and North Africa.*

1. `https://maps.google.com/`

4 Loading Maps

Whenever a map is generated by the AIS Indexer, it is automatically saved in the `Saved Maps` folder as a text file. These text files can be loaded at any time and viewed in a *Map Viewer*.

To open a saved map, from the *Main Panel*, click on *Open Map* and use the file explorer to navigate to the map you wish to open, select it then click the *Open* button. See Figure 7 for a view of the file explorer.

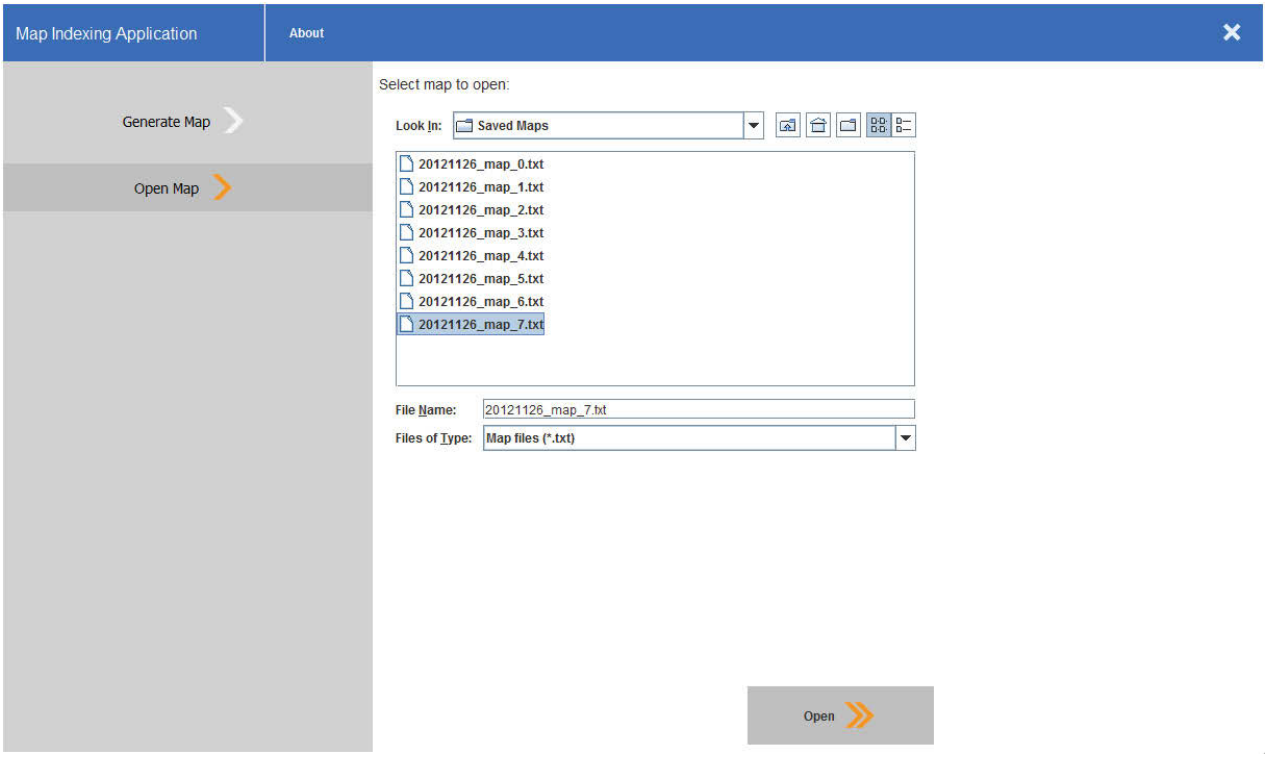

Figure 7: *Screenshot of the file explorer displayed to the user when loading existing maps.*

5 Monitoring Ship Traffic

From the *Map Viewer* interface, the user can also monitor live ship traffic. Monitoring uses the same socket connection as live map generation however the two processes are completely separate. In short, monitoring ship traffic compares incoming AIS messages to the current map. If a message originates from a cell with a strong reception index, the ship that reported the message will be expected to report again. If it doesn't, an alert will appear on the right hand panel of the *Map Viewer*. The user will also be alerted of ships that reappear after having been reported as missing. For a more detailed description of how monitoring works, refer to [2].

The monitoring panel includes the option to set the index threshold for ships to be monitored. AIS messages that originate from cells with indices below this threshold will be ignored.

When an alert appears, selecting it will place a marker on the map indicating the position of origin of the AIS report that triggered the alert. See Figure 8 for an example of the alerts list and display on the map.

All alerts are saved to a file in the `Monitored Alerts` folder. These files represent a monitoring *session*. A session starts when the monitoring button is toggled on and ends when it is toggled off or the user closes the *Map Viewer*.

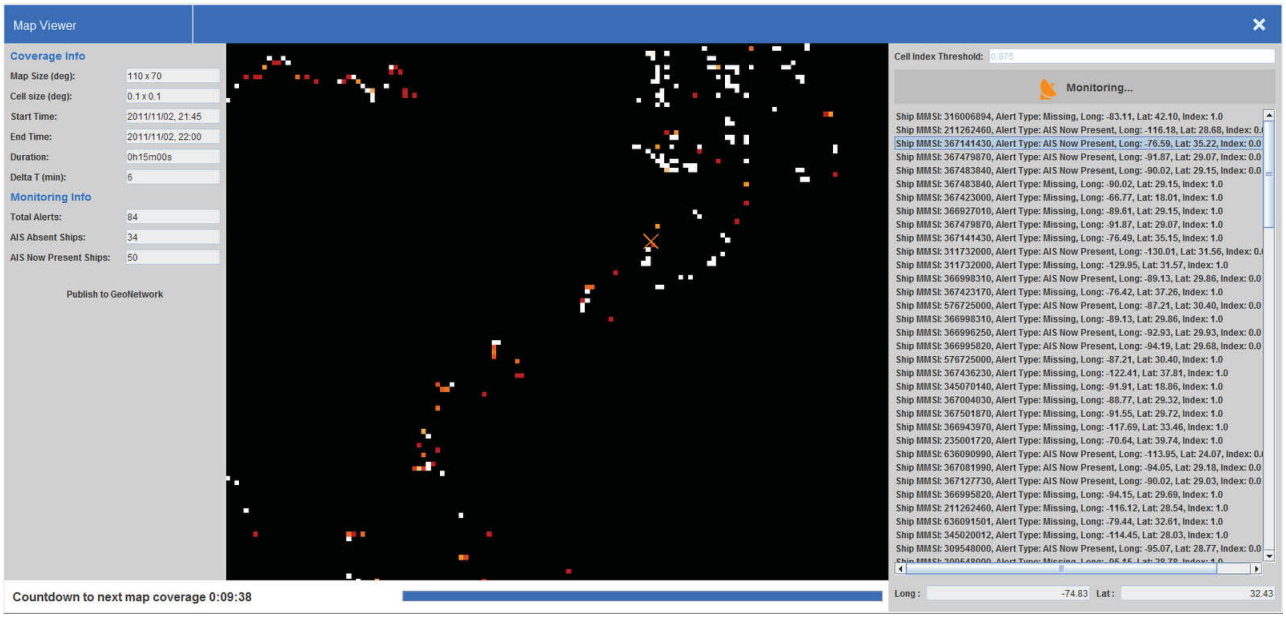

Figure 8: *Screenshot of the Map Viewer when the ship monitoring is on. The position of the selected alert (on the right side) is displayed on the map with a cross.*

6 Publishing Maps To GeoNetwork

From the *Map Viewer*, the user can also publish the current map to the GeoNetwork website by clicking on the *Publish to GeoNetwork* button. In the case of live maps, the button is toggable and maps will be published as they continue refreshing. In the case of static and loaded maps, the button can simply be clicked once to publish the map. The *Publish to GeoNetwork* button is in the left part of the *Map Viewer* (see Figure 6 and 8). This functionality assumes that GeoNetwork is up and running on the network. Refer to [3] for more details about the publishing functionality.

The user is warned however to avoid publishing live maps with high refresh rates. For example, if a map that refreshes every 2 min is left running for one hour, then the GeoNetwork site will have received 30 publications by the end of the hour. Deleting these publications must be done case by case and can become tedious. To facilitate long term maintenance, it is therefore preferable to publish sparingly.

References

[1] D., Radulescu (2012), AIS Coverage Estimate - Completion of Java Program for Computing AIS Index.

[2] D., Radulescu (2012), AIS Indexer Development Report.

[3] M.-O., St-Hilaire and M., Mayrand (2012), Automatic Publication of a MIS Product to GeoNetwork - Case of the AIS Indexer.

List of symbols/abbreviations/acronyms/initialisms

AIS	Automatic Identification System
AOI	Area Of Interest
DRDC	Defence Research and Development Canada
FIFO	First-In, First-Out
GB	Gigabyte
hrs	hours
IP	Internet Protocol
min	minutes
ms	milliseconds
MSARI	Maritime Situational Awareness Research Infrastructure
MSSIS	Maritime Safety and Security Information System
MVP	Model View Presenter
s	seconds
UI	user interface